

ESRF

Determination of Local Lattice Structure of the Oxygen Deficient Perovskite $\text{La}_{8-x}\text{Sr}_x\text{Cu}_8\text{O}_{20}$ System by EXAFS

Experiment number:
HS-377

Beamline:

BM29-BL18

Date of report:
24.08.97

Shifts:

12

Local contact(s):

A. Filipponi

Received at ESRF:

2 SEP. 1997

Names and affiliations of applicants (* indicates experimentalists):

N.L. Saini*, A. Lanzara*, F. Natali* and S. Grande* and A. Bianconi
Dipartimento di Fisica, Universita di Roma "La Sapienza" 00185 Roma, Italy

T. Ito and H. Oyanagi
Electrotechnical Laboratory, Tsukuba, Japan

Report:

We have studied the local structural effects associated with the anomalous transport and magnetic behavior of the $\text{La}_{8-x}\text{Sr}_x\text{Cu}_8\text{O}_{20}$ System with doping and temperature. Polarized Cu K-edge x-ray absorption (XANES and EXAFS) were recorded on two samples with different doping as a function of temperature. The experiment was conducted at the ESRF beamline BM29-BL18 during the allocated time of 12 shifts, starting from July 1, 1997.

Evidences for local lattice derived electronic phase transitions is increasing in different families of perovskites. The good example are the high temperature superconductors and the magnetoresistive manganites. Thus, the effect has been a field of intense research during last few years. The motif of this experiment was to study the effect in another family of oxygen deficient perovskite, $\text{La}_{8-x}\text{Sr}_x\text{Cu}_8\text{O}_{20}$ that has appeared to shows electronic and magnetic transitions with temperature and doping. At a critical doping of $x=1.6$, the system shows strong electronic anomaly at a temperature $\sim 150\text{K}$ seen in resistivity and Hall coefficient measurements.

The high quality polarized data obtained during the last run (HS-377) on sample at the anomalous doping ($x=1.64$) shows that the electronic anomaly is simultaneously followed by a local structural transition showing an anomalous behaviour of the local geometry at around the anomalous temperature. Fig. 1 shows representatives of the XANES spectra measured at 25 K on two samples with $x=1.64$, that is known to show anomalous electronic/magnetic instability at about 150 K, and $x=2.24$, that is out of the electronic/magnetic instability with temperature. The apparent difference between the local geometry of the two samples is evidently seen by splitted multiple scattering peak C (inset). Moreover, the temperature dependence of the XANES peaks show that the local geometry of the sample with $x=1.64$ goes through an anomalous transition at around the 150 K, the temperature at which the transport and magnetic anomalies have been observed. The results are being interpreted. We have shown temperature dependence of the relative intensity of the XANES peak B for the sample with $x=1.64$ in Fig. 2. The step like transition appears at -150 K. Thus the results show that the electronic/magnetic transition in the system is strongly contributed by local structural effects.

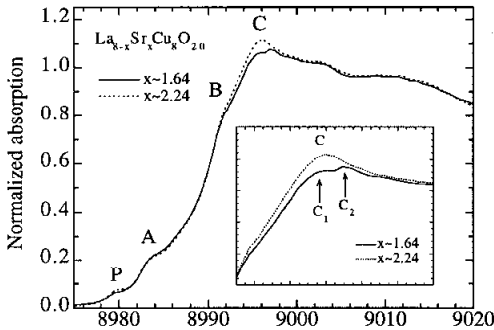


Fig. 1. XANES spectra

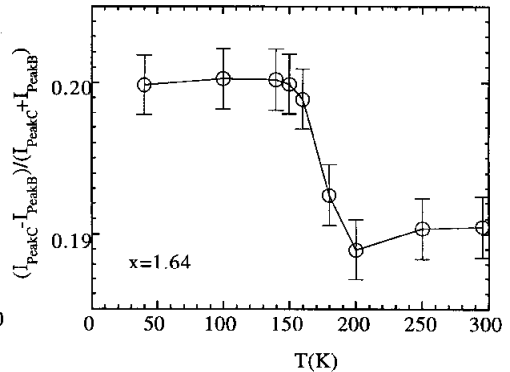


Fig.2. Temperature dependence

The preliminary analysis of the Cu K-edge EXAFS data on the sample at the anomalous doping ($x=1.64$) suggests that there is a strong temperature dependence of the Cu-O pair distribution with temperature. Additionally, the local structure of the rock-salt layer is strongly influenced with temperature as found by analysis of the Cu-La pair. The data are being analysed for quantitative information on the local structural parameters and their temperature dependence.